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Construction of a centralised microprocessor based smart metering system with optimised scheduling of energy usage

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Abstract :

Rapid economic growth in Zambia has resulted in increased electricity consumption. A presentation done by the former managing Director for Zambia Electricity Supply Corporation (ZESCO) showed that households consume 50% of total electricity production. More efficient use of existing supply can significantly reduce the number of new generators, leading to large financial savings. Zambia is replacing analogue post-paid meters with digital pre-paid meters which allow communication between consumer and supplier. This study proposed constructing a centralised microprocessor-based smart metering system (smart meter) that controls houses connected to the same substation (transformer). The first part of the study focused on establishing the power usage pattern for selected appliances and water heating systems. This information was used to develop the management software, which provided usage information to the user, and automatically rescheduled water heating to off-peak hours. An electronic circuit was designed and constructed based on the Motorola MC 68000 microprocessor. According to ZESCO figures, water heating accounts for 50% of household electricity usage. Automatic rescheduling of water heating system using the smart meter has shown significant reduction in peak-hour load. This is evident from the load factor calculations which showed an increase from 20% to 66%. Overall, this research addressed the problem of peak hour load, thus minimising the incidence of load shedding without increasing the number of power stations. The system design and construction demanded the skills of two discipline; firstly hardware concepts through electronics and secondly programming skills through computational physics.

Award :

Yes

Level :

Msc

Supervisor :

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Paper :

Yes

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